Metacognitions and Misappraisal of Cravings in Current and Former Smokers

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Abstract

Models of obsessive-compulsive disorder (OCD) posit that appraisals of intrusive thoughts as highly personally meaningful drive the performance of compulsions and rituals to alleviate the anxiety associated with these thoughts. Recently, catastrophic and dysfunctional appraisals of cravings have been hypothesized to drive smoking behaviors in smokers currently engaged in a cessation effort (Nosen & Woody, 2009). Indeed, certain anxiety-related factors such as anxiety sensitivity (AS) and misappraisals of cravings have been found to predict relapse (Assayag, Bernstein, Zvolenksy, Steeves, & Stewart, 2012; Johnson, Stewart, Steeves, & Zvolensky, 2012; Nosen & Woody, 2009). However, the differences between current and former smokers with regards to AS and craving appraisals have yet to be examined. The purpose of the present study is to investigate the metacognitive differences between current and former smokers. Ninety current and former (recent quitters and long-term quitters) smokers completed measures of dysfunctional metacognitions, craving appraisals, obsessive-compulsive smoking behaviors, anxiety sensitivity, and negative affect. Current smokers scored higher than long-term quitters on many of these constructs, while mixed results were observed for the differences between recent quitters and current smokers, and recent quitters and long-term quitters. Negative affect was found to account for many of these differences, but did not account for the differences between current smokers and recent quitters, and between current smokers and long-term quitters, with regards to obsessive-compulsive smoking. The differences between recent quitters and long-term quitters on beliefs about responsibility for harm and perfectionism/intolerance of uncertainty also remained significant after controlling for negative affect.

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Metacognitions and Misappraisal of Cravings in Current and Former Smokers

Cigarette smoking is the most common addiction in the United States and is responsible for more than 480,000 deaths annually (ASAM, 2010; CDC, 2014). In 2010, roughly 53% of all adult smokers had attempted to quit within the past year, but only 6.2% were successful (CDC, 2011). Because these deaths and many other complications associated with cigarette smoking can be reduced or prevented by quitting (for reviews, see USDHHS, 2014 and CDC, 2014), research efforts that focus on the factors that contribute to cessation success will facilitate the development of more effective cessation programs.

Smoking cessation is widely studied in the realms of public health and psychology, particularly related to the factors that influence treatment outcomes for smokers currently engaged in tobacco cessation programs (e.g. Dorner, Tröstl, Womastek,& Groman, 2011; Vangeli, Stapleton, Smit, Borland, & West, 2011). The efficacy of these treatment programs depends on identifying the factors that contribute to successful abstinence from smoking. More specifically, in order for cessation programs to effectively target the difficulties experienced by smokers during their attempts to quit, the psychological aspects of cessation must be examined in both current and former smokers.

Indeed, some existing research on smoking cessation has examined the cognitive factors related to smoking behaviors and those cognitive factors that may predict relative cessation success and lapse/relapse. Spada, Nikčević, Monetta, & Wells (2007) found that depression, a metacognitive construct related to cognitive confidence, anxiety, and both positive and negative beliefs about worry were associated with smoking dependence. Trait worry has been found to be associated with negative-affect reduction smoking motives and perceived cessation barriers (Peasley-Miklus, McLeish, Schmidt, & Zvolensky, 2012). Further research suggests that greater

self-efficacy and confidence in one's ability to quit, as well as waiting at least 30 minutes after waking before smoking, predicts success (Kahn, et al., 2012; Li, et al., 2010). On the other hand, factors such as heightened pain perception, smoking within five minutes of waking, smoking at all during the first two weeks after cessation, and having attempted to quit multiple times previously predicts relapse (Kahn, et al., 2012; Kenford et al., 1994; Nakajima & al'Absi, 2011). Finally, research suggests that negative affect and perceived stress predict relapse in women, while craving-reduction motivation predicts relapse for men (Nakajima & al'Absi, 2012).

Factors related to cravings (e.g. duration, urge intensity upon waking, expectations of positive outcomes of smoking, craving intensity upon initiating abstinence) have also been found to predict relapse in smokers actively trying to quit (e.g., Berlin, Singleton, & Heishman, 2013; Shiffman et al., 1997; Sweitzer, Denlinger, & Donny, 2013). However, though cravings may persist in some smokers, for those who are able to remain abstinent, cravings rapidly decrease over the cessation effort (Hughes, 2010; Nosen, 2012; Ussher, Beard, Abikoye, Hajek, & West, 2013). The relationship between cravings, cessation, and treatment outcome has been examined extensively with mixed findings. In a systematic review of the associations between cravings and cessation in 62 separate studies, Wray, Gass, and Tiffany (2013) found that only approximately half of the 198 conducted analyses yielded significant results and suggest that many factors may interact with cravings to predict cessation success.

Meanwhile, other research has begun to investigate anxiety-related factors that may contribute to the prediction of lapse/relapse episodes. Because panic disorder is associated with increased rates of smoking (McCabe, Chudzik, Antony, Young, Swinson, & Zvolensky, 2004), previous research has examined factors related to panic psychopathology and other anxiety-related constructs and their role in maintaining smoking behaviors and cessation difficulty

(Johnson, Farris, Schmidt, Smits, & Zvolensky, 2013; Zvolensky, Schmidt, & Stewart, 2003). These factors include anxiety sensitivity and specific metacognitions associated with obsessive-compulsive disorder (OCD), notably the appraisal of cravings as highly, personally meaningful (Nosen & Woody, 2009).

Indeed, anxiety-related factors, specifically anxiety-sensitivity, have been examined with particular attention to their associations with negative affect (e.g. Langdon et al., 2013; Evatt & Kassel, 2010). Research suggests that smoking maintenance may be in part explained by findings which suggest smoking alleviates negative affect (i.e. unpleasant emotions) related to withdrawal (Perkins, Karelitz, Conklin, Sayette, & Giedgowd, 2010; Zinser, Baker, Sherman, & Cannon 1995). Anxiety sensitivity (AS), the fear of arousal-related sensations due to beliefs that detrimental consequences will arise from these sensations (Reiss & McNally, 1985), contributes to this issue. Schmidt, Lerew, and Joiner (1998) found that physical concerns as measured by the Anxiety Sensitivity Index (ASI) predicted both anxiety and depression symptoms (i.e. negative affect) and suggest that this is due to covariation between these symptoms. Specifically, anxiety sensitivity is associated with addictive smoking motives (i.e. alleviating unpleasant withdrawal states) (Leyro, Zvolensky, Vujanovic, & Bernstein, 2008) and smoking motives to reduce negative affect (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Leyro et al., 2008). Additionally, the specific anxiety sensitivity factors related to cognitive/psychological and physical sensations are positively associated with negative affect reduction (Zvolensky, Bonn-Miller, Bernstein, & Marshall, 2006; Battista et al., 2008).

Further, individuals with elevated AS may perceive withdrawal symptoms as highly distressing and may therefore experience increased difficulties with cessation (Zvolensky & Bernstein, 2005). Smokers high in anxiety sensitivity perceive high, sustained levels of

withdrawal symptom severity over the course of treatment, as opposed to smokers low in AS who see a decrease in severity during this time, and are more likely to relapse (Assayag, Bernstein, Zvolenksy, Steeves, & Stewart, 2012; Johnson, Stewart, Steeves, & Zvolensky, 2012). Anxiety sensitivity may also predict susceptibility to lapse within the first week of quitting, which thus reduces the individual's chances of success as noted above (Brown et al., 2001). Research by Zvolensky and Bernstein (2005) suggests that smokers with elevated AS may engage in harmful cognitive constructs such as catastrophic thinking towards their withdrawal symptoms, which motivates them to engage in negative-affect-reduction smoking behaviors (i.e. relapse). However, little research has been done on the relationship between catastrophic thinking and the intrusive, mental cravings associated with withdrawal.

Nosen and Woody (2009) have proposed that these types of cravings are analogous to the unwanted, distressing, and intrusive thoughts experienced by those with OCD. Models of OCD posit that people who misinterpret or misappraise their intrusions as highly meaningful attempt to neutralize the anxiety associated with these thoughts by engaging in compulsions or rituals (Salkovskis, 1985; Salkovskis, Richards, & Forrester, 1998). Therefore, Nosen and Woody (2009) propose that smokers attempting to quit who misappraise their cravings as highly significant will engage in a neutralizing behavior, i.e. smoking, to alleviate the anxiety associated with their cravings. In order to examine this phenomena, they investigated the relationship between smokers' interpretations of their cravings as meaningful and smokers' cessation efforts. The results indicate that smokers attempting to quit were more likely to have lapsed or relapsed as early as one-month post-treatment if they appraised their cravings as highly meaningful or significant, and reported more extreme craving-related thoughts, images, and impulses as measured by the Appraisals of Cravings Questionnaire and Catastrophic Appraisals Index

(ACQ/CAI; Nosen & Woody, 2009). Further, they found that smokers who expressed these interpretations experienced more intense, frequent, and distressing craving-related intrusions.

In a follow-up study, Nosen (2012) assessed the impact of metacognitive psychoeducation on smokers either actively attempting to quit or anticipated to quit in the near future. Smokers who were presented with metacognitive psychoeducation appraised their cravings as less meaningful (as measured by the ACQ) even before cessation than smokers presented with general cessation psychoeducation or no psychoeducation; this effect remained at one-month follow-up after cessation. Further, smokers who successfully remained abstinent reported their cravings as being less meaningful than smokers who had lapsed or relapsed. Treatment implications for these findings include implementing aspects of cognitive-behavioral therapy (CBT) used for the treatment of OCD in cessation programs (Nosen & Woody, 2009). Since CBT for OCD is very effective at targeting maladaptive interpretations of obsessive thoughts (for a review, see Abramowitz, 2006) aspects of this therapy may be applicable to aiding cessation efforts.

While the body of existing research is useful in gaining an understanding of how anxiety and related metacognitions play a role in cessation efforts for current smokers actively engaged in cessation efforts, little research exists on how these thoughts are held by former smokers, particularly long-term abstainers and more recent quitters. If former smokers are not high in AS and/or do not appraise their cravings as highly meaningful relative to current smokers, this may indicate that these constructs change over the course of long-term cessation. Therefore, future research may benefit from further directing treatment efforts towards targeting anxiety-related cognitive constructs. Additionally, models of addictive behaviors can benefit from additional understanding of the role that obsessive beliefs, anxiety sensitivity, and craving appraisals may

play in long-term cessation efforts. Factors such as elevated anxiety sensitivity and catastrophic misappraisal of cravings have been shown to predict relapse, so successful quitters (i.e., former smokers) may differ from current smokers with regards to these constructs. Therefore, the present study examined the differences between current smokers, recent quitters, and long-term quitters with regards to dysfunctional appraisals of thoughts and cravings, anxiety sensitivity, negative affect, and obsessive-compulsive smoking in order to investigate the relationship between smoking status and anxiety-related metacognitions. I hypothesized that relative to current smokers, long-term smokers would present significantly less anxiety sensitivity, catastrophic appraisal of cravings, preoccupation with smoking, and obsessional beliefs, and would report their appraisals of cravings as being less personally meaningful. I also hypothesized that recent quitters would fall between current smokers and long-term quitters on measures of these constructs, differing significantly between the two.

Method

Participants

Participants qualified for inclusion in the study if they reported being at least 18 years of age and to have smoked at least 100 cigarettes in their lifetime. Participants were recruited from the UNC-Chapel Hill Psychology 101 Participant Pool prescreen questionnaire based on the above criteria and participated in the study for one hour of course-required research participation credit. Community members, faculty, and employees were recruited through links placed within a mass email and advertisements placed throughout the UNC campus. Participants recruited in this manner were given the option of being placed into a drawing for the chance to win one of six $50 Amazon gift cards.

The participants were able to endorse identification with one or more race/ethnicity, and were 82.22% White, 8.9 % African-American, 5.6% American Indian or Alaska Native, 4.4% Asian, and 6.7% "other." Most of the participants were female (n = 54, 60.00%). The average age of the participants was 37.33 (range: 18-62, *SD* = 13.74). The majority of current smokers (n = 27, 57.45%) reported that they had stopped smoking for at least one day within the last twelve months in an attempt to quit, indicating that most of the current smokers in the sample were unsuccessful quitters within the last year. Current smokers also endorsed a moderate level of nicotine dependence.

Participants were placed into one of three groups based on their current smoking status and how long it had been since they last smoked a cigarette. Of the 98 participants who qualified, provided informed consent, and completed the survey, 90 fell into either the current or former group. Participants who indicated that they were currently smoking at least "some days" or "every day," and had smoked within the last month, were classified as "current" smokers (n = 47). Those who indicated that they were not smoking at all and had not smoked within the last month were classified as "former" smokers. Former smokers were further divided into "recent quitters," those who reported having not smoked in at least one month, but had smoked during the last year (n = 13), and "long-term quitters," those who reported having not smoked in at least one year (n = 30). All participants responded appropriately to an attention check question inserted into the middle of the survey, indicating that participants followed study directions and read questions carefully.

Procedure

Qualifying participants were directed to a web-based survey (Qualtrics) link through email, where they were presented with a consent form. Upon providing consent, participants

were asked to complete each of the following measures and additional demographic questions before being shown a debriefing screen. Community members, faculty, and employees were then given the option to follow a separate Qualtrics link to enter their email address for entry into the gift card drawing.

Measures

Participants were first asked to report their age, gender, and race before completing the following measures of anxiety, smoking behavior and tobacco use, nicotine dependence, and beliefs about their thoughts and cravings.

Obsessional Beliefs Questionnaire –Threat, Responsibility, Importance and control of thoughts, Perfectionism and intolerance of uncertainty (OBQ-TRIP; Moulding, Anglim, Nedeljkovi, Doron, Kyrios, & Ayalon, 2011). The OBQ-TRIP is a shortened version of the Obsessional Beliefs Questionnaire (OCCWG, 1997; OCCWG, 2001; OCCW, 2003), which assesses beliefs thought to underlie faulty appraisals of one's thoughts. The OBQ-TRIP is composed of a four-factor structure to assess overestimation of threat (OBQ-T), personal responsibility for harm (OBQ-R), the importance of controlling one's thoughts (OBQ-I), and perfectionism/intolerance of uncertainty (OBQ-P) (Moulding et al., 2011). The 20-item measure includes statements such as "For me, having bad urges is as bad as actually carrying them out," "Having bad thoughts means I am weird or abnormal," and "Having intrusive thoughts means I'm out of control" to be rated on a 7-point Likert scale, from disagree very much (1) to agree very much (7). The OBQ-TRIP has demonstrated adequate internal consistency and strong correlations with other measures of obsessive beliefs (Fergus & Carmin, 2013; Moulding et al., 2011). OBQ-TRIP subscale scores were totaled separately and used individually for analyses in the current study.

Anxiety Sensitivity Index – Third Version (ASI-3; Taylor et al., 2007). The ASI-3 is an 18-item self-report measure assessing fears of physical, arousal-related sensations and their consequences. It is composed of three subscales that assess different dimensions of the fear of arousal-related body sensations. The dimensions are (a) fears of physically observable symptoms (e.g., sweating), (b) fears of cognitive/mental consequences (e.g., concentration difficulty), and (c) fears of physical catastrophes (e.g., heart attack) (Zinbarg et al., 1997; see, Taylor, 1999, for a review; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). The ASI-3 has demonstrated adequate reliability (Osman et al., 2010), and good validity (Taylor et al., 2007) and stability across the three-factor structure (Wheaton, Deacon, McGrath, Berman, & Abramowitz, 2012). Items include statements such as "When I have trouble thinking clearly, I worry that there is something wrong with me" and "When my chest feels tight, I get scared that I won't be able to breathe properly" to be rated on a 5-point Likert scale from very little (0) to very much (4). ASI-3 subscales were separately totaled and used individually for analyses.

Depression, Anxiety, and Stress Scale – 21 (DASS; Antony, Bieling, Cox, Enns, & Swinson, 1998; Lovibond & Lovibond, 1995). The shortened version of the DASS is a 21-item self-report measure assessing depression, anxiety, and stress over the last week. The DASS is composed of three subscales measuring depression (DASS-D; e.g. dysphoria, hopelessness, anhedonia), anxiety (DASS-A; e.g., autonomic arousal, situational anxiety, subjective experience of anxious affect), and stress (DASS-S; e.g., difficulty relaxing, irritability, nervous arousal) (Lovibond & Lovibond, 1995). Statements such as "I couldn't seem to experience any positive feeling at all" and "I found it hard to wind down" were rated from never (did not apply to me at all), to almost always (applied to me very much, or most of the time). The DASS-21 has demonstrated excellent internal consistency and strong convergence with other widely used

measures of negative affect/general distress in both clinical and non-clinical populations (e.g. Antony et al., 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997; Crawford & Henry, 2003; Henry & Crawford, 2005; Norton, 2007). Individual subscale totals were used for group comparison, while DASS total scores were used to control for negative affect.

Appraisals of Cravings Questionnaire and Catastrophic Appraisals Index (ACQ/CAI; Nosen & Woody, 2009). The ACQ and CAI were developed by Nosen and Woody (2009) for their preliminary examination of obsessive-compulsive metacognitions and smoking cessation. The combined measures were developed from modifying the Interpretations of Intrusions Inventory (III; OCCWG, 1997, 2001, 2003), which assesses dysfunctional appraisals of thoughts. Specifically, the ACQ assesses smokers' interpretations of the thoughts, images, and impulses related to nicotine cravings that they experience. The CAI assesses more catastrophic interpretations of these thoughts. Participants are asked to list two unwanted nicotine-related intrusive thoughts that they experience (e.g. an image of themselves smoking or the thought that they would really enjoy a cigarette) and are then questioned on their appraisals of these intrusions. Items from the combined measure include statements such as "Having this thought means that my attempts to quit smoking are destined to fail" and "I will go crazy if I do not stop thinking these thoughts." These statements are rated on agreement from 0 (I do not believe this idea at all) to 100 (I am completely convinced this idea is true). The ACQ and CAI have correlated significantly with other measures of obsessional thought assessment and have demonstrated acceptable concurrent validity and internal consistency (Nosen & Woody, 2009; Nosen, 2012). While the measure was originally designed for the ACQ and CAI to be combined, Nosen and Woody (2009; also, Nosen, 2012) separated them due to infrequent endorsement of

CAI items. For the purposes of the current study, the measures were again separated. ACQ and CAI subscales were averaged and used individually for analyses.

Obsessive-Compulsive Smoking Scale (OCSS; Hitsman et al. 2010). The OCSS was adapted from the Obsessive-Compulsive Drinking Scale (Anton, 2000) to assess preoccupation with smoking and compulsive behavior related to smoking. The OCSS has demonstrated excellent internal consistency and reliability and concurrent validity (Hitsman et al., 2010). The 10-item self-report scale is divided into two subscales: preoccupation with smoking (i.e. the amount of time per day engaged with smoking-related thoughts) and compulsive drive (i.e. efforts to resist smoking and perceived control over urges). The preoccupation subscale includes items such as "How much of your time when you're not smoking is occupied by ideas, thoughts, impulses, and images related to smoking?" and "How frequently do these thoughts occur?" The compulsive drive subscale includes items such as "In general, how strong is your urge to smoke cigarettes?" and "In general, how much control do you have over smoking?" OCSS subscales were separately totaled and used individually for analyses.

Tobacco Use from the Behavioral Risk Factor Surveillance System (BRFSS; CDC, 2013). Questions from the BRFSS were used to determine various aspects of tobacco use such as frequency of use and recent quit attempts. Participants were asked to indicate either yes or no to the following questions: "Have you smoked at least 100 cigarettes in your entire life?," "During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking?" Participants were also asked to indicate how frequently they smoke by answering, "Do you now smoke cigarettes every day, some days, or not at all?" Finally, participants were asked, "How long has it been since you last smoked a cigarette, even one or two puffs?," and indicated their response by selecting a time interval (e.g. "within the last

month," "within the past three months," "within the past six months," etc.). These questions were used to further categorize current and former smokers into more specific groups (i.e. currently smoking, recently quit smoking, long-term quitter).

Fagerström Test for Nicotine Dependence (FTND; Heatherton et al. 1991). The Fagerström Test for Nicotine Dependence is a six-item self-report measure assessing nicotine dependence. Items include questions such as, "How soon after you wake up do you smoke your first cigarette? (After 60 minutes, 31-60 minutes, 6-30 minutes, within 5 minutes)" and "How many cigarettes per day do you smoke? (10 or less, 11-20, 21-30, 31 or more)." This measure has demonstrated adequate psychometric properties in (Heatherton et al., 1991; Japuntich, Piper, Schlam, Bolt, & Baker, 2009). The FTND was totaled to assess current smokers' level of nicotine dependence.

Results

Group Mean Comparisons

A series of one-way analyses of variance (ANOVAs) were conducted in order to compare differences in obsessive beliefs about one's thoughts, anxiety sensitivity, appraisals of cravings, and obsessive-compulsive smoking between current smokers, recent quitters (< 1 year), and long-term quitters (> 1 year). Descriptive statistics for all study measures by group are reported in Table 1.

Negative affect. To examine differences in negative affect between current and former smokers, we conducted three one-way ANOVAs comparing groups on the DASS subscales. These analyses revealed significant differences between groups on the depression subscale, $F(2, 87) = 5.23$, $p = .007$, the anxiety subscale, $F(2,87) = 6.08$, $p = .003$, and the stress subscale, $F(2, 87) = 3.92$, $p = .024$. Tukey's HSD post-hoc tests indicated that for each of these subscales,

current smokers reported significantly higher distress than long-term quitters (DASS-D, p = .009; DASS-A, p = .002; DASS-S, p = .018). There were no significant differences between recent quitters and the other two groups. In other words, current smokers and recent quitters presented similar affect to each other but much more negative affect than former smokers.

Because negative affect may account for a significant amount of variance between groups, ANCOVAs controlling for DASS total scores were conducted for each subsequent analysis in which a significant main effect was observed.

Obsessional beliefs. To examine differences in obsessional beliefs between current and former smokers, we conducted four one-way ANOVAs comparing groups on the OBQ subscales. These analyses revealed significant main effects of group on each subscale of the OBQ: OBQ-T, $F(2, 87) = 5.47$, p = .006; OBQ-R, $F(2, 87) = 5.19$, p = .007; OBQ-I, $F(2, 87) = 5.32$, p = .007; and OBQ-P, $F(2, 87) = 8.70$, p = .000.

Post hoc comparisons using Tukey's HSD tests indicated the only significant difference on threat was that current smokers reported significantly greater overestimation of threat than long-term quitters, p = .007. Additionally, recent quitters reported significantly higher responsibility for harm than long-term quitters, p = .008; there were no other significant differences between groups on responsibility. Current smokers reported significantly lower perfectionism/intolerance of uncertainty (PC) than recent quitters, p = .002, while recent quitters reported significantly higher PC than long-term quitters, p = .000. Finally, while there was no significant difference observed between current smokers and recent quitters, current smokers reported significantly higher importance of controlling thoughts (ICT) than long-term quitters, p = .013. Similarly, recent quitters reported significantly higher ICT than long-term quitters, p = .03.

An ANCOVA controlling for negative affect was conducted for each of the OBQ subscales, and these analyses revealed that only the main effects of group on responsibility for harm, $F(2, 86) = 3.24$, $p = .044$ and perfectionism/certainty, $F(2, 86) = 10.49$, $p = .000$ remained significant. For responsibility, pairwise comparisons indicated that the difference between recent and long-term quitters was still significant, $p = .038$. With regards to perfectionism/certainty, the difference between current smokers and recent quitters remained significant, $p = .000$, as did the difference between recent and long-term quitters, $p = .002$.

Anxiety sensitivity. To examine differences in anxiety sensitivity between current and former smokers, we conducted three one-way ANOVAs comparing groups on the ASI subscales. A significant main effect of group was not found for the social, $F(2, 87) = 2.86$, $p = .063$ or the physical, $F(2, 87) = 2.93$, $p = .059$, subscales of the ASI.

However, a significant main effect of group on the cognitive subscale of the ASI was observed, $F(2, 87) = 4.26$, $p = .017$. Post hoc tests indicated that only the difference between current smokers and long-term quitters was significant, $p = .018$. After controlling for negative affect, the main effect, $F(2, 86) = 1.54$, $p = .22$ was no longer significant.

Appraisals of cravings. To examine differences in appraisals of cravings between current and former smokers, we conducted two one-way ANOVAs comparing groups on the ACQ and CAI. On the measure of more general appraisals of cravings (ACQ), a significant main effect of group was observed, $F(2, 86) = 7.14$, $p = .001$. Tukey's HSD post-hoc test indicated that the only significant difference was that current smokers reported significantly more meaningful appraisals of cravings than did long-term quitters, $p = .001$. After controlling for negative affect, the main effect was no longer significant, $F(2,85) = 2.82$, $p = .06$.

A significant main effect of group was observed for the measure of catastrophic appraisals of cravings (CAI), $F(2, 86) = 6.70$, $p = .002$. Tukey's HSD post-hoc tests indicated that both current smokers and recent quitters endorsed significantly more catastrophic appraisals than long-term quitters, *p*'s = .002, .029 respectively. There was no significant difference between current smokers and recent quitters, $p = .98$. After controlling for negative affect, there were no longer significant differences between groups, $F(2, 85) = 2.37$, $p = .10$.

Obsessive-compulsive smoking. To examine differences in obsessive-compulsive smoking between current and former smokers, we conducted two one-way ANOVAs comparing groups on the OCSS subscales. A significant main effect of group on preoccupation with smoking was observed, $F(2, 87) = 21.12$, $p = .000$. Tukey's HSD post-hoc tests indicated that current smokers reported significantly higher preoccupation than both recent quitters, $p = .047$, and long-term quitters, $p = .000$. There was no significant difference between recent and long-term quitters, $p = .08$. The main effect remained significant after controlling for negative affect, $F(2, 86) = 13.01$, $p = .000$, as did the differences between current smokers and recent quitters, $p = .029$ and between current smokers and long-term quitters, $p = .000$.

Similarly, a significant main effect of group on compulsive drive to smoke was also observed, $F(2, 87) = 34.47$, $p = .000$. Post hoc tests indicated the same relationship for compulsive drive as preoccupation; current smokers reported significantly higher compulsive drive than both recent quitters, $p = .001$, and long-term quitters, $p = .000$. The main effect of group on compulsive drive remained after controlling for negative affect, $F(2, 86) = 25.75$, $p = .000$, as did both the differences between current smokers and recent quitters, $p = .001$, and current smokers and long-term quitters, $p = .000$.

Discussion

The aim of the present study was to examine the differences between current and former smokers on measures of metacognitive, obsessive beliefs; anxiety sensitivity; and appraisals of cravings as, to date, the relationships between some of these constructs have only been examined in current smokers and smokers actively attempting to quit. Further, the differences in obsessive-compulsive smoking-related cognitive patterns have yet to be examined in current and former smokers.

As hypothesized, current smokers generally reported more obsessive beliefs than former smokers. However, of the four obsessive-belief constructs, the only difference between current smokers and recent quitters that remained significant after controlling for negative affect was with regards to perfectionism/intolerance of uncertainty; contrary to our hypothesis, current smokers actually reported less perfectionism than recent quitters. Interestingly, while recent quitters differed significantly from long-term quitters on three out of four obsessive-belief constructs, only responsibility for harm and perfectionism/intolerance of uncertainty remained significant after controlling for negative affect. While this may suggest a slight peak in obsessive beliefs related to perfectionism/intolerance of uncertainty shortly after a successful cessation attempt, the relatively small sample size of recent quitters limits this conclusion. On the other hand, this peak in perfectionism/intolerance of uncertainty could stem from recent quitters' desires to remain abstinent, leading them to more frequently endorse statements such as, "I should be upset if I make a mistake" and "I must keep working at something until it's done exactly right," particularly if they are uncertain in their ability to remain abstinent. This may suggest that holding certain dysfunctional beliefs about one's thoughts can actually aid in cessation success. However, whether or not these recent quitters will relapse is to be determined, so holding these types of beliefs could also inhibit long-term success.

Hypotheses about anxiety sensitivity were only somewhat supported. The only significant difference between current and former smokers on anxiety sensitivity was observed between current smokers and long-term quitters with regards to fears of cognitive manifestations of anxious arousal; however, these differences were accounted for by negative affect. One explanation for these findings could be that since this specific anxiety sensitivity construct is related to motivation to reduce negative affect, and since the former smokers in the present study reported significantly lower negative affect, it follows that their anxiety sensitivity would be much lower than current smokers. If former smokers are not already feeling anxious, they may have no motivation to neutralize these feelings, and therefore be less inclined to smoke.

As hypothesized, current smokers differed significantly from long-term quitters with regards to their general craving appraisals. However, this difference was no longer significant after controlling for negative affect. Current smokers, as well as recent quitters, also differed significantly from long-term quitters on more extreme appraisals of cravings but, again, these effects were no longer significant after controlling for negative affect. When considering that the majority of current smokers in the present study were unsuccessful in quitting at some point over the last year, these findings, combined with the AS findings above, extend those that find successful quitters experience significantly larger changes in craving appraisals than unsuccessful quitters and that this change is predicted by changes in negative affect and motivation to smoke to relieve negative affect (Nosen, 2012). This fits Nosen's (2012) metacognitive model of cessation which supposes that negative affect affects how one appraises their cravings; the current smokers in the present study reported more negative affect than long-term quitters, which may be why negative affect accounted for their higher misappraisals of cravings.

As hypothesized, current smokers were significantly more preoccupied with thoughts about smoking than both recent and long-term quitters. In addition, these differences were also found with regards to compulsive drive to smoke. These findings are consistent with correlational studies that suggest obsessive-compulsive smoking is negatively correlated with reductions in smoking and time since last cigarette (Hitsman et al., 2010). Recent quitters did not differ from long-term quitters on obsessive-compulsive smoking, supporting research that suggests smoking urges and cravings, though still present in some smokers, generally rapidly decrease shortly after initiating a successful cessation attempt (Daughton et al., 1999; Gritz, Carr, & Marcus, 1991; Hughes, 2010; Nosen, 2012; Ussher et al., 2013). Even after controlling for negative affect, current smokers reported that thoughts about smoking and urges to smoke occur much more frequently and severely than former smokers. These findings suggest that once smokers are able to stay abstinent for a certain amount of time, they find the frequency and severity of urges to smoke, smoking-related thoughts, and effort needed to resist smoking decrease, while perceived control over smoking urges increases. These findings are consistent with those that suggest significant cravings do not persist into late abstinence (Hughes, 2010; Ussher et al., 2013).

These findings taken together suggest that while current and former smokers differ with regards to their fears of cognitive consequences of anxiety, misappraisals of cravings, and many realms of obsessive beliefs, negative affect/general distress is the common, underlying factor for these differences. These results, combined with previous research (Nosen, 2012) support models of addictive behaviors that present negative affect as the primary driving factor for engaging in these behaviors (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). However, negative affect did not account for the fact that both recent and long-term quitters encounter thoughts about

smoking and urges to smoke much less frequently and severely than current smokers do per day; nor did it account for the fact that former smokers feel less compulsive drive to smoke than current smokers do. These results suggest that if former smokers have fewer cravings to negatively appraise they may experience a decrease in negative affect, which in turn may lead to less motivation to reduce negative affect, leading to less cravings, etc. Other factors not examined in the present study, however, such as changes in self-efficacy over the course of cessation, may factor into this cycle as well.

The present study has a number of limitations. First, the small sample size, particularly of the recent quitters group, may have limited our ability to detect differences that may actually exist. Additionally, the study included only self-report survey measures which participants completed online from any location they chose. One concern about this design is participant attention to the task. While our attention check question reduced this concern slightly, this design did not allow for the controlling of distractions or other external factors while completing study measures. Another concern is the validity of self-report measures concerning smoking behaviors; smoking was not biochemically validated. Next, current smokers were not further divided into groups based on whether they had attempted to quit within the last year and then compared to former smokers. It is possible that unsuccessful quitters differ significantly from both current smokers and former smokers, as previous research suggests that recently unsuccessful smokers endorse more meaningful appraisals of cravings than current smokers (Nosen, 2012).

The findings and limitations of this study may prompt future research to further examine metacognitions and craving-appraisals in current and former smokers. While previous research has examined the changes in these cognitive constructs over brief cessation, the findings of the present study suggest that a more longitudinal investigation of successful abstainers may yield

further insight into these changes, particularly with regards to changes in negative affect over cessation efforts. Treatment implications for these findings include not only manipulating appraisals of cravings (e.g. Nosen, 2012), but also concentrating on the directionality of changes in these appraisals and changes in affect over the course of long-term cessation. Longitudinal studies focusing on successful quitters may yield insight into this relationship. Additionally, the long-term differences between successful and unsuccessful quitters should be further examined. Finally, the implications for long-term success on endorsing certain dysfunctional beliefs related to perfectionism and intolerance of certainty within the first year of abstinence should be examined.

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Table 1.

Means (and standard deviations) on all measures by group

	Current smokers	Recent quitters (< 1year)	Long-term quitters (> 1 year)
DASS Depression[b]	10.04 (11.46)	10.77 (11.24)	3.20 (4.69)
DASS Anxiety[b]	7.32 (7.42)	5.08 (3.88)	2.47 (3.63)
DASS Stress[b]	12.47 (8.58)	11.23 (6.86)	7.53 (6.05)
OBQ Threat[b]	15.21 (6.47)	15.38 (5.44)	10.73 (5.78)
OBQ Responsibility[c*]	17.79 (5.76)	21.00 (6.83)	14.60 (6.75)
OBQ Perfectionism/Certainty[a*,c*]	13.15 (6.44)	20.23 (5.75)	11.40 (6.78)
OBQ Control of Thoughts[b,c]	10.06 (4.27)	10.77 (4.25)	7.40 (3.14)
ASI Social	9.13 (5.47)	10.38 (5.25)	6.73 (4.92)
ASI Physical	5.51 (4.65)	5.00 (4.88)	3.10 (3.38)
ASI Cognitive[b]	4.30 (4.78)	2.23 (1.79)	1.67 (3.38)
ACQ[b]	37.38 (23.82)	31.04 (24.82)	17.12 (19.80)
CAI[b,c]	17.07 (20.13)	17.95 (15.02)	3.76 (7.54)
OCSS Preoccupation[a*,b*]	5.98 (3.42)	3.85 (1.57)	1.80 (2.11)
OCSS Compulsive Drive[a*,b*]	5.49 (3.05)	2.69 (1.55)	0.93 (1.14)

[a]Significant difference observed between current smokers and recent quitters

[b]Significant difference observed between current smokers and long-term quitters

[c]Significant difference observed between recent quitters and long-term quitters

*Difference remained significant after controlling for negative affect